

CPC**COOPERATIVE PATENT CLASSIFICATION****F23D****BURNERS** (generating combustion products of high pressure or high velocity F23R)**F23D 1/00****Burners for combustion of pulverulent fuel** (disposition of burners F23C)

F23D 1/005

- . {burning a mixture of pulverulent fuel delivered as a slurry, i.e. comprising a carrying liquid (preparing slurries F23K 1/02)}

F23D 1/02

- . Vortex burners, e.g. for cyclone-type combustion apparatus

F23D 1/04

- . Burners producing cylindrical flames without centrifugal action

F23D 1/06

- . Burners producing sheet flames

Combustion of a liquid**F23D 3/00****Burner using capillary action**

F23D 3/02

- . Wick burners

F23D 3/04

- .. with flame spreaders (F23D 3/12 takes precedence)

F23D 3/06

- .. Inverted wick burners, e.g. for illumination

F23D 3/08

- .. characterised by shape, construction, or material, of wick

F23D 3/10

- .. Blue-flame burners

F23D 3/12

- ... with flame spreaders

F23D 3/14

- ... with mixing of air and fuel vapour in a chamber before the flame

F23D 3/16

- .. using candles (candles per se C11C)

F23D 3/18

- .. Details of wick burners

F23D 3/20

- ... Flame spreaders

F23D 3/22

- ... Devices for mixing evaporated fuel with air

F23D 3/24

- ... Carriers for wicks

F23D 3/26

- Safety devices thereon

F23D 3/28

- ... Wick-adjusting devices

F23D 3/30

- directly engaging with the wick

F23D 3/32

- engaging with a tube carrying the wick

F23D 3/34

- Wick stop devices; Wick-fixing devices

F23D 3/36

- ... Devices for trimming wicks

F23D 3/38

- ... Devices for replacement of wicks

F23D 3/40

- . the capillary action taking place in one or more rigid porous bodies

F23D 5/00 **Burners in which liquid fuel evaporates in the combustion space, with or without chemical conversion of evaporated fuel**

- F23D 5/02 . the liquid forming a pool, e.g. bowl-type evaporators, dish-type evaporators
- F23D 5/04 .. Pot-type evaporators, i.e. using a partially-enclosed combustion space
- F23D 5/045 ... {with forced draft}

- F23D 5/06 . the liquid forming a film on one or more plane or convex surfaces
- F23D 5/08 .. on cascaded surfaces
- F23D 5/10 .. on grids

- F23D 5/12 . Details
- F23D 5/123 .. {Inserts promoting evaporation}
- F23D 5/126 .. {Catalytic elements}
- F23D 5/14 .. Maintaining predetermined amount of fuel in evaporator
- F23D 5/16 .. Safety devices
- F23D 5/18 .. Preheating devices

F23D 7/00 **Burners in which drops of liquid fuel impinge on a surface**

F23D 9/00 **Burners in which a stream of liquid fuel impinges intermittently on a hot surface**

F23D 11/00 **Burners using a direct spraying action of liquid droplets or vaporised liquid into the combustion space (spraying in general B05B, B05D)**

- F23D 11/001 . {spraying nozzle combined with forced draft fan in one unit (nozzles per se [F23D 11/38](#))}
- F23D 11/002 . {spraying nozzle arranged within furnace openings (refractory bricks or blocks specially shaped for burner openings [F23M 5/025](#))}
- F23D 11/004 .. {for producing radiant heat}
- F23D 11/005 . {with combinations of different spraying or vaporising means}
- F23D 11/007 .. {combination of means covered by sub-groups [F23D 11/10](#) and [F23D 11/24](#)}
- F23D 11/008 .. {combination of means covered by sub-groups [F23D 5/00](#) and [F23D 11/00](#)}

- F23D 11/02 . the combustion space being a chamber substantially at atmospheric pressure

- F23D 11/04 . the spraying action being obtained by centrifugal action
- F23D 11/06 .. using a horizontal shaft
- F23D 11/08 .. using a vertical shaft

- F23D 11/10 . the spraying being induced by a gaseous medium, e.g. water vapour
- F23D 11/101 .. {medium and fuel meeting before the burner outlet}

- F23D 11/102 . . . {in an internal mixing chamber}
- F23D 11/103 {with means creating a swirl inside the mixing chamber}
- F23D 11/104 . . . {intersecting at a sharp angle, e.g. Y-jet atomiser}
- F23D 11/105 . . . {at least one of the fluids being submitted to a swirling motion}
- F23D 11/106 . . {medium and fuel meeting at the burner outlet}
- F23D 11/107 . . . {at least one of both being subjected to a swirling motion}
- F23D 11/108 . . {medium and fuel intersecting downstream of the burner outlet}
- F23D 11/12 . . characterised by the shape or arrangement of the outlets from the nozzle
- F23D 11/14 . . . with a single outlet, e.g. slit
- F23D 11/16 . . in which an emulsion of water and fuel is sprayed
- F23D 11/18 . . the gaseous medium being water vapour generated at the nozzle
- F23D 11/20 . . . the water vapour being superheated
- F23D 11/22 . . the gaseous medium being vaporised fuel, e.g. for a soldering lamp, {or other gaseous fuel}

- F23D 11/24 . . by pressurisation of the fuel before a nozzle through which it is sprayed by a substantial pressure reduction into a space
- F23D 11/26 . . with provision for varying the rate at which the fuel is sprayed
- F23D 11/28 . . . with flow-back of fuel at the burner, e.g. using by-pass
- F23D 11/30 . . . with return feed of uncombusted sprayed fuel to reservoir

- F23D 11/32 . . by electrostatic means

- F23D 11/34 . . by ultrasonic means {or other kinds of vibrations}
- F23D 11/345 . . {with vibrating atomiser surfaces}

- F23D 11/36 . . Details {e.g. burner cooling means, noise reduction means}
- F23D 11/38 . . Nozzles (nozzles in general [B05B](#)); Cleaning devices therefor
- F23D 11/383 . . . {with swirl means}
- F23D 11/386 . . . {Nozzle cleaning}
- F23D 11/40 . . Mixing tubes [or chambers]; Burner heads
- F23D 11/402 . . . {Mixing chambers downstream of the nozzle}
- F23D 11/404 . . . {Flame tubes (not forming part of the burner [F23M 9/06](#))}
- F23D 11/406 . . . {Flame stabilising means, e.g. flame holders}
- F23D 11/408 . . . {Flow influencing devices in the air tube}
- F23D 11/42 . . Starting devices ([igniting F23Q](#))
- F23D 11/44 . . Preheating devices; Vaporising devices ([vaporising devices per se F23K 5/22](#))
- F23D 11/441 . . . { Vaporizing devices incorporated with burners}
- F23D 11/443 {heated by the main burner flame}
- F23D 11/445 {the flame and the vaporiser not coming into direct contact}
- F23D 11/446 {heated by an auxiliary flame}
- F23D 11/448 {heated by electrical means}
- F23D 11/46 . . Devices on the vaporiser for controlling the feeding of the fuel

- F23D 14/00 Burners for combustion of a gas, e.g. of a gas stored under pressure as a liquid**
- F23D 14/02 . Premix gas burners, i.e. in which gaseous fuel is mixed with combustion air upstream of the combustion zone
 - F23D 14/04 .. induction type, e.g. Bunsen burner, ({atmospheric or aerated gas burner})
 - F23D 14/045 ... {with a plurality of burner bars assembled together, e.g. in a grid-like arrangement}
 - F23D 14/06 ... with radial outlets at the burner head
 - F23D 14/065 {with injector axis inclined to the burner head axis}
 - F23D 14/08 ... with axial outlets at the burner head
 - F23D 14/085 {with injector axis inclined to the burner head axis}
 - F23D 14/10 ... with elongated tubular burner head
 - F23D 14/105 [N. with injector axis parallel to the burner head axis]

 - F23D 14/12 . Radiant burners
 - F23D 14/125 .. {heating a wall surface to incandescence}
 - F23D 14/14 .. using screens or perforated plates
 - F23D 14/145 ... {the burner plate being a screen}
 - F23D 14/16 .. using permeable blocks
 - F23D 14/18 .. using catalysis for flameless combustion

 - F23D 14/20 . Non-premix gas burners, i.e. in which gaseous fuel is mixed with combustion air on arrival at the combustion zone ([F23D 14/30](#) to [F23D 14/44](#) take precedence)
 - F23D 14/22 .. with separate air and gas feed ducts, e.g. with ducts running parallel or crossing each other
 - F23D 14/24 ... at least one of the fluids being submitted to a swirling motion
 - F23D 14/26 . with provision for a retention flame ([pilot flame igniters F23Q 9/00](#))
 - F23D 14/28 . in association with a gaseous fuel source, e.g. acetylene generator, or a container for liquefied gas
 - F23D 14/30 . Inverted burners, e.g. for illumination
 - F23D 14/32 . using a mixture of gaseous fuel and pure oxygen or oxygen-enriched air ([F23D 14/38](#) takes precedence)
 - F23D 14/34 . Burners specially adapted for use with means for pressurising the gaseous fuel or the combustion air ([F23D 14/38](#) takes precedence)
 - F23D 14/36 .. in which the compressor and burner form a single unit
 - F23D 14/38 . Torches, e.g. for cutting, brazing, welding or heating ({ nozzles for torches [F23D 14/52](#)})
 - F23D 14/40 .. for welding ([F23D 14/44](#) takes precedence)
 - F23D 14/42 .. for cutting ([F23D 14/44](#) takes precedence)
 - F23D 14/44 .. for use under water

- F23D 14/46 . Details {e.g. noise reduction means}
- F23D 14/465 .. {for torches (F23D 14/52 takes precedence)}
- F23D 14/48 .. Nozzles ({injectors for mixing devices F23D 14/64}; for spraying or coating B05B)
- F23D 14/50 ... Cleaning devices therefor
- F23D 14/52 ... for torches; for blow-pipes
- F23D 14/54 for cutting or welding metal
- F23D 14/56 ... for spreading the flame over an area, e.g. for desurfacing of solid material, for surface hardening, for heating workpieces, (scarfing by applying flames B23K 7/00)
- F23D 14/58 ... characterised by the shape or arrangement of the outlet or outlets from the nozzle, e.g. of annular configuration
- F23D 14/583 {of elongated shape, e.g. slits}
- F23D 14/586 {formed by a set of sheets, strips, ribbons or the like}
- F23D 14/60 .. Devices for simultaneous control of gas and combustion air (regulation of combustion in general F23N)
- F23D 14/62 .. Mixing devices; Mixing tubes
- F23D 14/64 ... with injectors
- F23D 14/66 .. Preheating the combustion air or gas
- F23D 14/68 .. Treating the combustion air or gas, e.g. by filtering, by moistening (in general B01)
- F23D 14/70 .. Baffles or like flow-disturbing devices
- F23D 14/72 .. Safety devices, e.g. operative in case of failure of gas supply (protection or supervision of pipe-line systems F17D 5/00)
- F23D 14/725 ... {Protection against flame failure by using flame detection devices (pilot flame igniters with interlock with main fuel supply F23Q 9/08)}
- F23D 14/74 ... Preventing flame lift-off (F23D 14/70 takes precedence)
- F23D 14/76 ... Protecting flame and burner parts
- F23D 14/78 ... Cooling burner parts
- F23D 14/80 ... Selection of a non-toxic gas
- F23D 14/82 ... Preventing flashback or blowback (F23D 14/70 takes precedence; {by use of a retention flame F23D 14/26}; in gas feed lines A62C 4/02)
- F23D 14/825 {using valves}
- F23D 14/84 .. Flame spreading or otherwise shaping (F23D 14/70 takes precedence)

Other burners

- F23D 17/00** **Burners for combustion conjointly or alternatively of gaseous or liquid or pulverulent fuel**
- F23D 17/002 . {gaseous or liquid fuel}
- F23D 17/005 . {gaseous or pulverulent fuel}
- F23D 17/007 . {liquid or pulverulent fuel}

- F23D 21/00** **Burners not otherwise provided for** { Note : combinations of spraying or vaporising means covered by sub-groups [F23D 5/00](#) and [F23D 21/00](#) are classified in [F23D 11/008](#)}
- [F23D 21/005](#) . { specially adapted for use in particular heating operations}
- F23D 23/00** **Assemblies of two or more burners** (gas burners with provision for a retention flame [F23D 14/26](#); disposition of burners F23C; for industrial furnaces F27)
- F23D 99/00** **Subject matter not provided for in other groups of this subclass**
- [F23D 99/003](#) . { specially adapted for use in particular heating operations}
- [F23D 99/006](#) .. { for heating liquids, e.g. for vaporising, for concentrating}
- F23D 2200/00** **Burners for fluid fuel**
- F23D 2201/00** **Burners adapted for particulate solid or pulverulent fuels**
- [F23D 2201/10](#) . Nozzle tips
- [F23D 2201/101](#) .. tiltable
- [F23D 2201/20](#) . Fuel flow guiding devices
- [F23D 2201/30](#) . Wear protection
- F23D 2202/00** **Liquid fuel burners**
- F23D 2203/00** **Gaseous fuel burners**
- [F23D 2203/002](#) . Radiant burner mixing tubes
- [F23D 2203/005](#) . Radiant burner heads
- [F23D 2203/007](#) . Mixing tubes, air supply regulation
- [F23D 2203/10](#) . Flame diffusing means
- [F23D 2203/101](#) .. characterised by surface shape
- [F23D 2203/1012](#) ... tubular
- [F23D 2203/1015](#) ... spherical
- [F23D 2203/1017](#) ... curved
- [F23D 2203/102](#) .. using perforated plates

- F23D 2203/1023 . . . with specific free passage areas
- F23D 2203/1026 . . . with slotshaped openings
- F23D 2203/103 . . using screens
- F23D 2203/104 . . Grids, e.g. honeycomb grids
- F23D 2203/105 . . Porous plates
- F23D 2203/1055 . . . with a specific void range
- F23D 2203/106 . . Assemblies of different layers
- F23D 2203/107 . . coated with catalysts
- F23D 2203/108 . . with stacked sheets or strips forming the outlets

F23D 2204/00 Burners adapted for simultaneous or alternative combustion having more than one fuel supply

- F23D 2204/10 . gaseous and liquid fuel
- F23D 2204/20 . gaseous and pulverulent fuel
- F23D 2204/30 . liquid and pulverulent fuel

F23D 2205/00 Assemblies of two or more burners, irrespective of fuel type

F23D 2206/00 Burners for specific applications

- F23D 2206/0005 . Liquid fuel burners adapted for use in locomotives
- F23D 2206/001 . Liquid fuel burners adapted for use in automobile steam boilers
- F23D 2206/0015 . Gas burners for use in retort furnaces
- F23D 2206/0021 . Gas burners for use in furnaces of the reverberatory, muffle or crucible type
- F23D 2206/0026 . Vapour burners adapted for use in illumination devices
- F23D 2206/0031 . Liquid fuel burners adapted for use in welding lamps
- F23D 2206/0036 . . Liquid fuel burners adapted for use in welding and cutting metals
- F23D 2206/0042 . Vapour burners for illumination by radiation, with vaporiser heated by an auxiliary flame
- F23D 2206/0047 . Vapour burners for illumination by radiation, with vaporiser heated by the main flame
- F23D 2206/0052 . Vapour burners for illumination by radiation, with vaporiser heated by conduction
- F23D 2206/0057 . Liquid fuel burners adapted for use in illumination and heating
- F23D 2206/0063 . . Catalytic burners adapted for use in illumination and heating
- F23D 2206/0068 . Gas burners for illumination with slot type nozzles

- F23D 2206/0073 . Gas burners for illumination with Argand nozzles
- F23D 2206/0078 . Gas burners adapted for use in lamps with preheated air
- F23D 2206/0084 . Gas burners adapted for use in ceiling and wagon lamps
- F23D 2206/0089 . Gas burners for illumination using acetylene as a fuel
- F23D 2206/0094 . Gas burners adapted for use in illumination and heating
- F23D 2206/10 . Turbines

- F23D 2207/00 Ignition devices associated with burner**

- F23D 2208/00 Control devices associated with burners**
- F23D 2208/005 . Controlling air supply in radiant gas burners
- F23D 2208/10 . Sensing devices

- F23D 2209/00 Safety arrangements**
- F23D 2209/10 . Flame flashback
- F23D 2209/20 . Flame lift-off / stability
- F23D 2209/30 . Purging

- F23D 2210/00 Noise abatement**
- F23D 2210/101 . using noise dampening material

- F23D 2211/00 Thermal dilatation prevention or compensation**

- F23D 2212/00 Burner material specifications**
- F23D 2212/005 . Radiant gas burners made of specific materials, e.g. rare earths
- F23D 2212/10 . ceramic
- F23D 2212/101 .. Foam, e.g. reticulated
- F23D 2212/103 .. Fibres
- F23D 2212/105 .. Particles
- F23D 2212/20 . metallic
- F23D 2212/201 .. Fibres

- F23D 2212/203 . . . Particles
- F23D 2213/00 Burner manufacture specifications**
- F23D 2214/00 Cooling**
- F23D 2700/00 TBD**
- F23D 2700/001 . Air supply for wick burners
- F23D 2700/002 . Wick burners without flame spreaders or burner hood
- F23D 2700/003 . Wick burners with flame spreaders or burner hood
- F23D 2700/004 . Inverted wick burners, wick burners using preheated air
- F23D 2700/005 . Wick burners using alcohol as a fuel
- F23D 2700/006 . Wick burners using oil as a fuel
- F23D 2700/009 . Details of blue flame wick burners
- F23D 2700/01 . Blue flame burners without flame spreader or burner hood
- F23D 2700/011 . Blue flame burners with flame spreader or burner hood without a bead at the wick carrying tube
- F23D 2700/012 . Blue flame burners with flame spreader or burner hood with a bead at the wick carrying tube
- F23D 2700/013 . Blue flame burners with flame on one side only without a bead at the wick carrying tube
- F23D 2700/014 . Blue flame burners with flame on one side only and a bead at the wick carrying tube
- F23D 2700/015 . Tubes carrying the wick
- F23D 2700/016 . Safety devices for wick carrying tubes
- F23D 2700/017 . Wick adjusting devices directly engaging the wick
- F23D 2700/018 . Wick adjusting devices engaging the tube carrying the wick
- F23D 2700/019 . Wick stop devices and wick fixing devices
- F23D 2700/02 . Devices for mounting the wick to the carrier
- F23D 2700/021 . Burners in which the gas produced in the wick is not burned instantaneously
- F23D 2700/022 . Burners using carburetted gas

- F23D 2700/023 . Gasifying and evaporating devices
- F23D 2700/024 . Nozzles and cleanig devices therefor
- F23D 2700/025 . Mixing tubes and burner heads
- F23D 2700/026 . Preheating devices, starting devices
- F23D 2700/027 . Vaporisers with devices for controlling the feeding of the fuel
- F23D 2700/03 . Alcohol vapour burners
- F23D 2700/031 . Vapour burners where the vaporiser is heated by an auxiliary flame
- F23D 2700/032 . Vapour burners where the vaporiser is heated by the main flame itself
- F23D 2700/033 . Vapour burners where the vaporiser is heated by conduction

- F23D 2900/00** **Special features of, or arrangements for burners using fluid fuels or solid fuels suspended in a carrier gas**

- F23D 2900/00001 . local catalytic coatings applied to burner surfaces
- F23D 2900/00002 . Cleaning burner parts, e.g. burner tips
- F23D 2900/00003 . Fuel or fuel-air mixtures flow distribution devices upstream of the outlet
- F23D 2900/00004 . Burners specially adapted for generating high luminous flames, e.g. yellow for fuel-rich mixtures
- F23D 2900/00006 . Liquid fuel burners using pure oxygen or O₂-enriched air as oxidant ([for gaseous fuels F23D 14/32](#))
- F23D 2900/00008 . Burner assemblies with diffusion and premix modes, i.e. dual mode burners
- F23D 2900/00011 . Burner with means for propagating the flames along a wall surface
- F23D 2900/00012 . Liquid or gas fuel burners with flames spread over a flat surface, either premix or non-premix type, e.g. "Flächenbrenner"
- F23D 2900/00013 . . with means for spreading the flame in a fan or fishtail shape over a melting bath
- F23D 2900/00014 . Pilot burners specially adapted for ignition of main burners in furnaces or gas turbines
- F23D 2900/00015 . Pilot burners specially adapted for low load or transient conditions, e.g. for increasing stability
- F23D 2900/00016 . Preventing or reducing deposit build-up on burner parts, e.g. from carbon
- F23D 2900/00017 . Assembled burner modules

- F23D 2900/00018 . Means for protecting parts of the burner, e.g. ceramic lining outside of the flame tube
- F23D 2900/00019 . Outlet manufactured from knitted fibres
- F23D 2900/01001 . Pulverised solid fuel burner with means for swirling the fuel-air mixture
- F23D 2900/03081 . Catalytic wick burners
- F23D 2900/03082 . Wick made of specific material, e.g. ceramic
- F23D 2900/05001 . Burner using gel type fuel
- F23D 2900/05002 . Use of porous members to convert liquid fuel into vapor
- F23D 2900/11001 . Impinging-jet injectors or jet impinging on a surface
- F23D 2900/11002 . Liquid fuel burners with more than one nozzle
- F23D 2900/11101 . Pulverising gas flow impinging on fuel from pre-filming surface, e.g. lip atomizers
- F23D 2900/11401 . Flame intercepting baffles forming part of burner head
- F23D 2900/11402 . Airflow diaphragms at burner nozzle
- F23D 2900/11403 . Flame surrounding tubes in front of burner nozzle
- F23D 2900/14 . Special features of gas burners
 - F23D 2900/14001 .. Sealing or support of burner plate borders
 - F23D 2900/14002 .. of premix or non premix types, specially adapted for the combustion of low heating value (LHV) gas
 - F23D 2900/14003 .. with more than one nozzle
 - F23D 2900/14004 .. with radially extending gas distribution spokes
 - F23D 2900/14005 .. Rotary gas burner
 - F23D 2900/14021 .. Premixing burners with swirling or vortices creating means for fuel or air
 - F23D 2900/14041 .. Segmented or straight line assembly of burner bars
 - F23D 2900/14042 .. Star shaped assembly of burner bars or arms
 - F23D 2900/14061 .. for cooking ranges having a coated burner cap
 - F23D 2900/14062 .. for cooking ranges having multiple flame rings
 - F23D 2900/14063 .. for cooking ranges having one flame ring fed by multiple venturis
 - F23D 2900/14064 .. Burner heads of non circular shape
 - F23D 2900/1412 .. for radiant burners
 - F23D 2900/14121 ... with radiation intensifying means
 - F23D 2900/14122 ... with extra radiation grids, e.g. strips or rods
 - F23D 2900/14123 ... with radiation intensifying perforated plates
 - F23D 2900/14124 ... cooperating with refractory wall surfaces
 - F23D 2900/14125 ... with extra radiation screens, e.g. wires, threads or gauzes

- F23D 2900/14181 . . . Catalytic type with carbon containing radiating surface
- F23D 2900/14241 . . Post-mixing with swirling means
- F23D 2900/14381 . . Single operating member opening and closing fuel and oxidant supply valves in torches
- F23D 2900/14481 . . Burner nozzles incorporating flow adjusting means
- F23D 2900/14482 . . Burner nozzles incorporating a fluidic oscillator
- F23D 2900/14581 . . with outlets consisting of a bed of irregular particles, e.g. glass
- F23D 2900/14582 . . with outlets consisting of layers of spherical particles
- F23D 2900/14641 . . with gas distribution manifolds or bars provided with a plurality of nozzles
- F23D 2900/14642 . . with jet mixers with more than one gas injection nozzles or orifices for a single mixing tube
- F23D 2900/14681 . . Adding steam or water vapor to primary or secondary combustion air
- F23D 2900/14701 . . Swirling means inside the mixing tube or chamber to improve premixing

- F23D 2900/21 . Burners specially adapted for a particular use
- F23D 2900/21001 . . for use in blast furnaces
- F23D 2900/21002 . . for use in car heating systems
- F23D 2900/21003 . . for heating or re-burning air or gas in a duct
- F23D 2900/21004 . . for use in gas fed fireplaces
- F23D 2900/21005 . . for flame deposition, e.g. FHD, flame hydrolysis deposition
- F23D 2900/21006 . . for heating a catalyst in a car
- F23D 2900/21007 . . for producing soot, e.g. nano particle soot